TABLE 4-4
Energies and energy densities of several storage devices

Device	Energy stored, J	Energy density, J m^{-3}
1-kV, 1-μF capacitor for power supply	0.5	5.2×10^3
5-V, 0.1-F capacitor for CMOS backup	1.25	3.1×10^6
Earth-electrosphere capacitor	1.5×10^{12}	1.2×10^{-7}
12-V, 100-ampere-hour battery for automobile	4.3×10^6	9.6×10^8

conductors of a long coaxial line so that the charge Q per unit length l of one conductor is ρ_L. The field is confined to the space between the two conductors. The field lines are radial, and the equipotential lines are concentric circles, as indicated in Fig. 4-12*b*. The magnitude of the field at a radius r is given by (2-10-1), where $a \le r \le b$, and where ρ_L is the charge per unit length on the inner conductor. The potential difference V between the conductors is, from (2-10-2),

$$V = \frac{\rho_L}{2\pi\epsilon} \ln \frac{b}{a} \tag{1}$$

Since capacitance is given by the ratio of charge to potential, $C = Q/V$. Dividing by length l we have $C/l = (Q/l)/V$. The ratio Q/l equals the linear charge density ρ_L (C m^{-1}). Hence, the *capacitance per unit length* C/l of the coaxial line

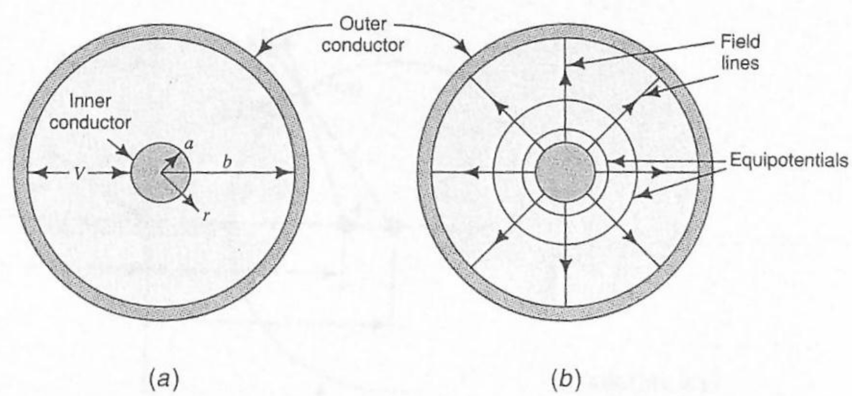

FIGURE 4-12
Coaxial transmission line.